



*U.S. Department of Energy's
Office of Science*

ARM Aerial Vehicle Program (AAVP)

*ASP Science Team Meeting
NOAA Skaggs Research Center*

Rickey Petty

October 27th, 2006



ARM Climate Research Facility (ACRF)

- SGP, NSA, & TWP
- ARM Mobile Facility
- ARM UAV
- ARM Data Archive

- ARM Science Program



ARM-UAV Program

- **The interaction of clouds and solar/thermal energy**
- **support the climate change community with valuable data sets**
- **develop measurement techniques and instruments suitable for use with the new class of high altitude, long endurance UAVs**
- **demonstrate these instruments and measurement techniques in field measurement campaigns**



ARM-UAV conducted 12 major field campaigns

Field Campaigns to date:

- Fall 1993, Edwards AFB, CA
- Spring 1994, Northern OK
- Fall 1995, Northern OK
- Spring 1996, Northern OK
- Fall 1996, Northern OK
- Fall 1997, Northern OK
- Spring 1999, PMRF Kauai, HI
- Summer 1999, Monterey, CA
- Winter 2000, Northern OK
- Fall 2002, Northern OK
- Fall 2004, North Slope, AK
- Winter 2006, Darwin, Australia



Proteus(F04, W06)



GA-ASI "GNAT 750"
(F93, S94)



Grob "Egrett"
(F95, S96)



GA-ASI "Altus I" (F96, F97)

GA-ASI "Altus II"
(Su99)



Twin Otter
(F93, S94, F95, S96, F96,
F97, Sp99, Su99, W00)





DOE National Laboratories

LAB 06-20

- July 31st, 2006
- Routine and IOP measurements
- Fostering of miniaturization instruments
- Funding \$2.7M
- PNNL



AAVP Overview

Objectives

Organization

Processes

This Years Goals

Future

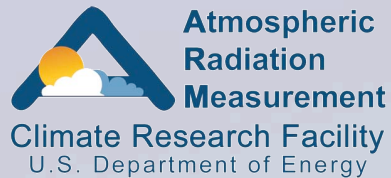


AAVP Objectives

- AAVP is an integral measurement capability of the ARM Climate Research Facility
- Building from the ARM UAV Program to provide key climate measurements using aerial platforms
- Science driven aerial missions will provide in situ measurements of cloud properties for campaigns and extended routine flights
- Enhance the utility and information content of long term measurements of the climate^[1]
- Improvement of ground based measurements
 - Retrievals
 - Spatial Representation
 - Testing and Evaluation of Models



AAVP Organization



DOE Program Manager
Rickey Petty

AVP Chief Scientist
Greg McFarquhar

Technical Director
Jimmy Voyles

**Mission Science and
Logistics Liaison**
Beat Schmid

**Aerial Vehicle, Instrumentation
Engineering and
Flight Support**
Jim Mather

Product Delivery
Matt McDuff



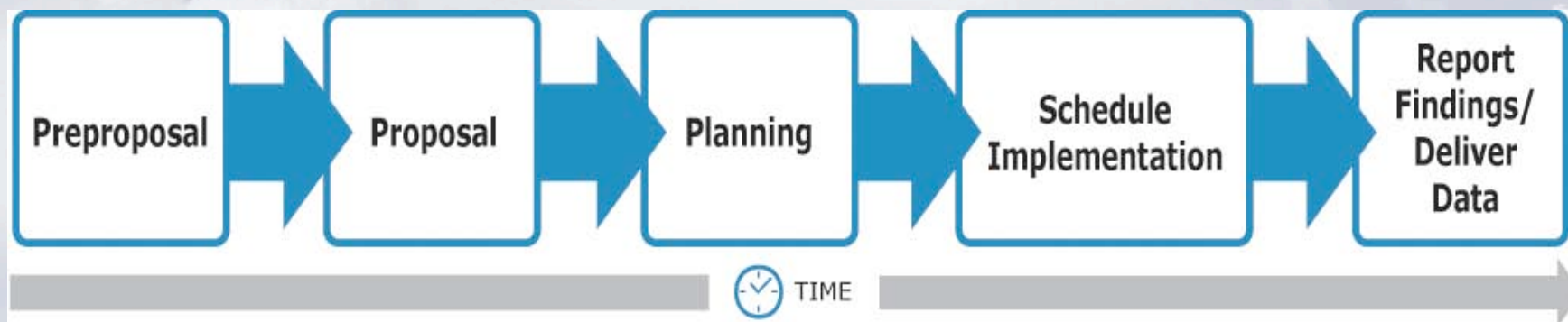
Processes

- Science Driven Resource Allocation and Planning Approach
- Utilize Existing ACRF Operational and Engineering Methodologies
- Timely Quality Assured Data Products
- The Aerial Vehicle must be DOE approved -"US DOE Accepted Aircraft Operators Database:"
<http://www.mbe.doe.gov/me2-4/acdb/about.cfm>



Mission Requests

Use existing ACRF Field Campaign and Intensive Operational Period Processes



www.arm.gov/science/fc.stm

Program Planning-Immediate Goals

- Organize FY2007 AAVP Plan; Program, Science and Infrastructure
- Coordinate and Integrate with ACRF Activities
- Support FY2007 Flight Mission (CLASIC)
- Support FY2008 Flight Mission(s) (ISDAC)
- Identify Additional Mission Requirements for FY2008

Cloud Land Surface Interaction Campaign (CLASIC) Science Questions

- What is the role of cumulus convection and spatial variations in land cover in depleting low-level water vapor as it is advected to the SGP from the Gulf of Mexico?
- How do cumulus clouds and aerosols impact the carbon flux and evapotranspiration and the coupling between the carbon flux and transpiration, and how does this impact feed back to cloud processes?
- How does the winter wheat harvest at the SGP impact the surface fluxes, boundary layer structure, cloud structure, and aerosol loading?

CLASIC

- June 9-30, 2007, at the SGP site
- Aircraft:
 - **ACRF/AAVP**; ER-2, Twin Otter, Cessna 206
 - **ACRF, AAVP, ASP and NASA**;
 - **ASP**; G-1, King Air (Hostetler)
 - **NASA**; Bell Helicopter
- Flight science planning meeting, February (Beat Schmid lead)
- Flight mission coordination meeting, April



CLASIC

Collaborators and Participants

- In conjunction with DOE ASP CHAPS Program
- In addition to the ARM Program, key contributors include
 - NASA
 - USDA
 - NOAA
- *Interagency collaborations facilitate the advance in scientific capabilities of CLASIC*



Future

- Support Approved AAVP Measurement and Mission Profiles
- General Research Questions
 - Scaling Issues
 - Statistics of Cloud and Radiative Properties at Multiple Levels and Locations
 - Observation of Complete Life Cycle of Clouds
 - Evaluation of Numerical Models using Data from a Wider Range of Conditions
 - Atmospheric Statistics in sparse data regimes
 - Data for Addressing Sub-Grid Variability
 - Long routine transects for Parameterization Development
 - Tropospheric/ Stratospheric Exchange